

The documentation and process conversion measures necessary to comply with this revision shall be completed by 9 January 2002.

INCH-POUND  
MIL-PRF-19500/420F  
9 October 2001  
SUPERSEDING  
MIL-PRF-19500/420E  
26 August 1999

## PERFORMANCE SPECIFICATION

SEMICONDUCTOR DEVICE, DIODE, SILICON, POWER, RECTIFIER, GENERAL PURPOSE  
TYPES 1N5550 THROUGH 1N5554, 1N5550US THROUGH 1N5554US  
JAN, JANTX, JANTXV, JANJ, JANS, JANHC, AND JANKC

This specification is approved for use by all Departments  
and Agencies of the Department of Defense.

### 1. SCOPE

1.1 Scope. This specification covers the performance requirements for silicon, general purpose, semiconductor diodes. Five levels of product assurance are provided for each encapsulated device type as specified in MIL-PRF-19500. Two levels of product assurance are provided for each unencapsulated device type.

1.2 Physical dimensions. See figure 1 (similar to D0-41) for 1N5550 through 1N5554, figure 2 for 1N5550US through 1N5554US, and figures 3, 4, 5, 6, and 7 for JANHC and JANKC die.

1.3 Maximum ratings. Unless otherwise specified,  $T_A = +25^\circ\text{C}$  and ratings apply to all case outlines.

Type	$V_{(BR)min}$	$V_{RWM}$	$I_{O1}$ $T_L = +55^\circ\text{C};$ $L = .375 \text{ inch}$ (1) (2) (3)	$I_{FSM}$ $I_O = 2 \text{ A dc}$ $t_p = 1/120 \text{ s}$ $T_A = +55^\circ\text{C}$	$T_{op}, T_{STG}$ ( $T_J$ )	$I_{O2}$ $T_A = +55^\circ\text{C}$ (2) (4)
		<u>V dc</u>	<u>A dc</u>	<u>A(pk)</u>	<u>°C</u>	<u>A dc</u>
1N5550, 1N5550US	240	200	5	100	-65 to +175	3
1N5551, 1N5551US	460	400	5	100	-65 to +175	3
1N5552, 1N5552US	660	600	5	100	-65 to +175	3
1N5553, 1N5553US	880	800	5	100	-65 to +175	3
1N5554, 1N5554US	1,100	1,000	5	100	-65 to +175	3

- (1) Derate linearly at 41.6 mA/°C above  $T_L = +55^\circ\text{C}$  at  $L = .375 \text{ inch}$  (9.53 mm).
- (2) An  $I_O$  of up to 6 A dc is allowable provided that appropriate heat sinking or forced air cooling maintains the maximum junction temperature at or below  $+175^\circ\text{C}$  as proven by the junction temperature rise test (see 6.5).  
Barometric pressure reduced:  
1N5550, 1N5551, 1N5552 - 8 mmHg (100,000 feet).  
1N5553, 1N5554 - 33 mmHg (70,000 feet).
- (3) Does not apply to surface mount devices.
- (4) Derate linearly at 25 mA/°C above  $T_A = +55^\circ\text{C}$ .

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Defense Supply Center, Columbus, ATTN: DSCC-VAC, P.O. Box 3990, Columbus, OH 43216-5000, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A  
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FSC 5961

1.4 Primary electrical characteristics. Unless otherwise specified,  $T_A = +25^\circ\text{C}$ .

Type	$V_f$ at $I_f = 9.0\text{ A(pk)}$ 2 percent duty cycle, 8.3 ms max pulse width		$I_{R1}$		$I_{R2}$ at $T_A = +100^\circ\text{C}$		$R_{\theta JL}$ $R_{\theta JEC}$
	Min V(pk)	Max V(pk)	$\mu\text{A dc (max) at } V_R\text{ (V dc)}$		$\mu\text{A dc (max) at } V_R\text{ (V dc)}$		See (1)
1N5550, 1N5550US	0.6	1.2	1.0	200	75	200	
1N5551, 1N5551US	0.6	1.2	1.0	400	75	400	
1N5552, 1N5552US	0.6	1.2	1.0	600	75	600	
1N5553, 1N5553US	0.6	1.3	1.0	800	75	800	
1N5554, 1N5554US	0.6	1.3	1.0	1,000	75	1,000	

(1)  $R_{\theta JL} \leq 22^\circ\text{C/W}$  for  $L = .375$ . $R_{\theta JEC} \leq 11^\circ\text{C/W}$  for  $L = 0$  (US version).

## 2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

## SPECIFICATION

## DEPARTMENT OF DEFENSE

MIL-PRF-19500 - Semiconductor Devices, General Specification for.

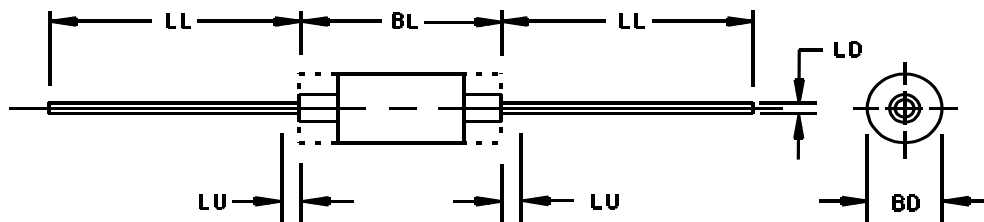
## STANDARD

## DEPARTMENT OF DEFENSE

MIL-STD-750 - Test Methods for Semiconductor Devices.

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Document Automation and Production Services (DAPS), Building 4D (DPM-DODSSP), 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

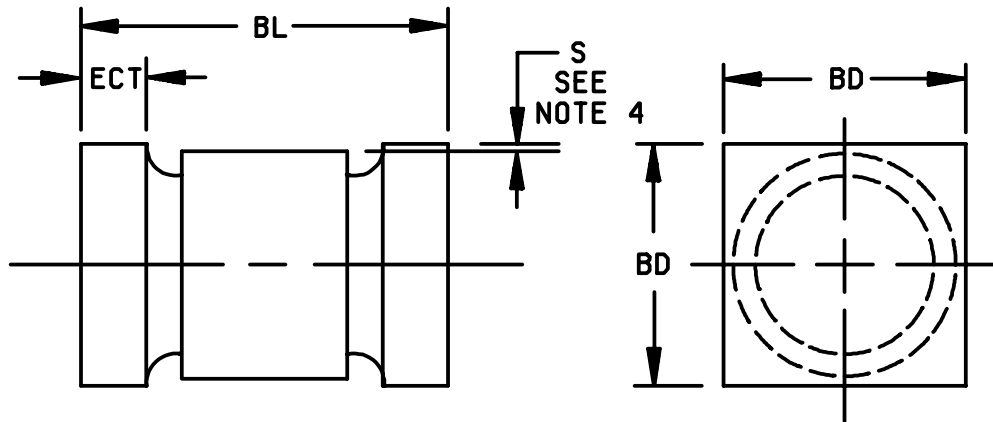


Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
BL	.130	.300	3.30	7.62	3
BD	.115	.180	2.92	4.57	3, 4
LD	.037	.042	0.94	1.07	
LL	.900	1.300	22.86	33.02	

## NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Dimensions BL and BD include all components of the diode periphery except the sections of leads over which the diameter is controlled.
4. Dimension BD shall be measured at the largest diameter.

FIGURE 1. Physical dimensions of diode 1N5550 through 1N5554, (similar to DO-41).



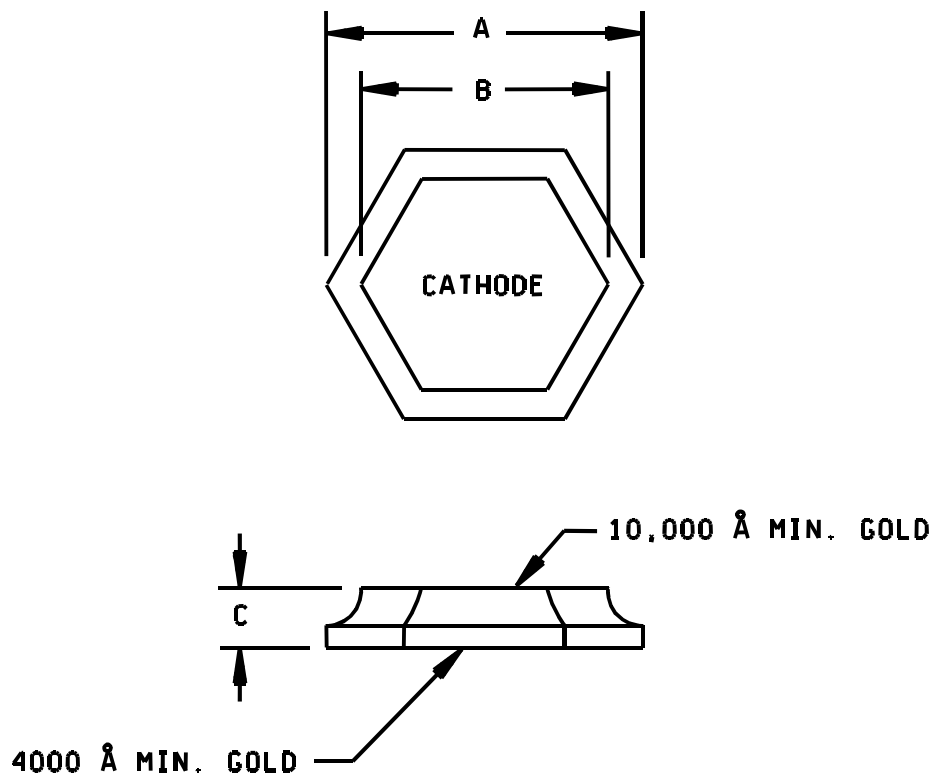
Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	.200	.275	5.08	6.99
BD	.137	.180	3.48	4.57
ECT	.019	.034	0.48	0.86
S	.003		0.08	

## NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Dimensions are pre-solder dip.
4. Minimum clearance of glass body to mounting surface on all orientations.

FIGURE 2. Physical dimensions of 1N5550US through 1N5554US.

MIL-PRF-19500/420F

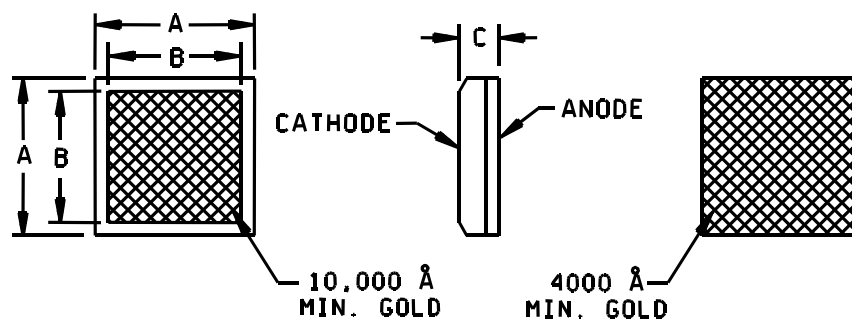


Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	.085	.091	2.16	2.31
B	.072	.078	1.83	1.98
C	.008	.014	0.20	0.36

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.

FIGURE 3. JANHCA and JANKCA (A-version) die dimensions.

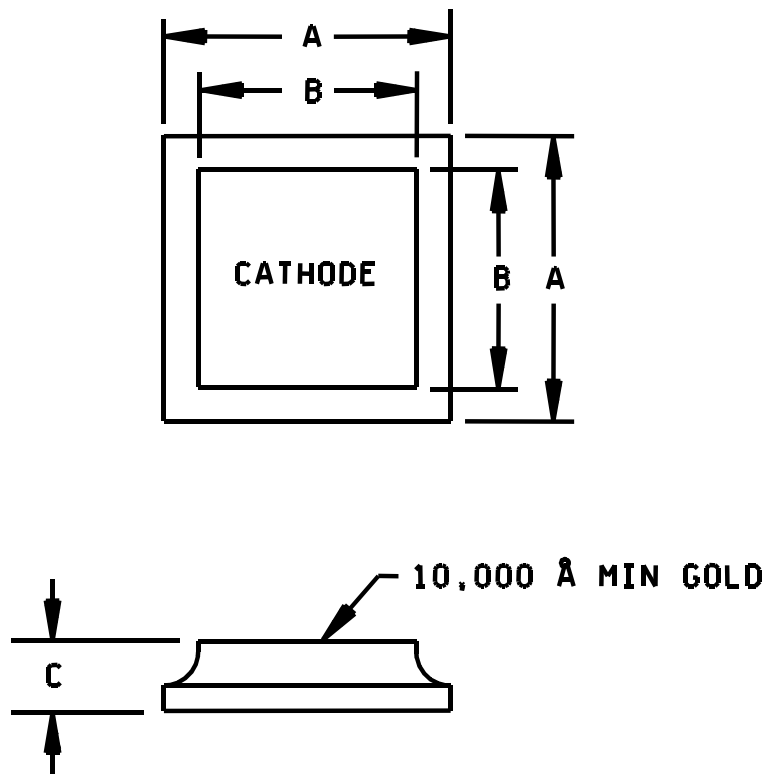


Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	.088	.092	2.24	2.34
B	.070	.077	1.78	1.96
C	.007	.035	0.18	0.89

## NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.

FIGURE 4. JANHCB (B-version) die dimensions.

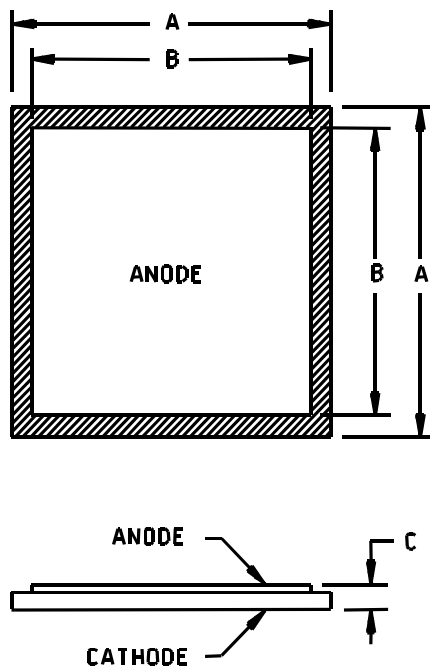


Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	.060	.065	1.52	1.65
B	.052	.058	1.32	1.47
C	.008	.014	0.20	0.36

## NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.

FIGURE 5. JANHCC (C-version) die dimensions.



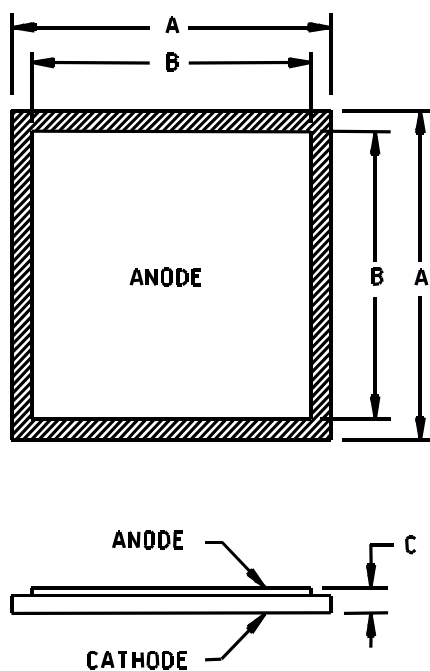
Letter	Inches		Millimeters	
	Min	Max	Min	Max
A	.081	.087	2.05	2.20
B	.055	.061	1.40	1.55
C	.007	.012	0.18	0.30

## Notes:

1. Anode is Aluminum at 60,000 Å minimum.
2. Cathode is gold at 2,500 Å nominal.

FIGURE 6. JANHCD and JANKCD (D-version) die dimensions.





Letter	Inches		Millimeters	
	Min	Max	Min	Max
A	.081	.087	2.05	2.20
B	.055	.061	1.40	1.55
C	.007	.012	0.18	0.30

## Notes:

1. Anode is Aluminum at 60,000 Å minimum.
2. Cathode is Al/Ti/Ni/Ag..

FIGURE 7. JANHCE and JANKCE (E-version) die dimensions.

### 3. REQUIREMENTS

3.1 General. The requirements for acquiring the product described herein shall consist of this document and MIL-PRF-19500.

3.2 Qualification. Devices furnished under this specification shall be products that are manufactured by a manufacturer authorized by the qualifying activity for listing on the applicable qualified manufacturer's list (QML) before contract award (see 4.2 and 6.3).

3.3 Abbreviations, symbols, and definitions. Abbreviations, symbols, and definitions used herein shall be as specified in MIL-PRF-19500.

3.4 Interface and physical dimensions. The interface and physical dimensions shall be as specified in MIL-PRF-19500 and on figure 1 (similar to DO-41) for 1N5550 through 1N5554, figure 2 for 1N5550US through 1N5554US, and figures 3, 4, 5, 6 and 7 (JANHC and JANKC).

3.4.1 Lead finish. Unless otherwise specified, lead finish shall be solderable in accordance with in MIL-PRF-19500, MIL-STD-750, and herein. Where a choice of lead finish is desired, it shall be specified in the acquisition document (see 6.2).

3.4.2 Diode construction. These devices shall be constructed utilizing non-cavity double plug construction with high temperature metallurgical bonding between both sides of the silicon die and terminal pins. Metallurgical bond shall be in accordance with the requirements of category I in MIL-PRF-19500. US version devices shall be structurally identical to the non-surface mount devices except for lead terminations.

3.5 Marking. Marking shall be in accordance with MIL-PRF-19500.

3.5.1 Marking of US version. For US version only, all marking may be omitted from the device except for the cathode marking. All marking which is omitted from the body of the device shall appear on the label of the initial container.

3.5.2 Polarity. The polarity shall be indicated with a contrasting color band to denote the cathode end. Alternately for surface mount (US) devices, a minimum of three evenly spaced contrasting color dots around the periphery of the cathode end may be used. No color coding will be permitted.

3.6 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in 1.3, 1.4, and table I herein.

3.7 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table I, group A herein.

3.8 Workmanship. Semiconductor devices shall be processed in such a manner as to be uniform in quality and shall be free from other defects that will affect life, serviceability, or appearance.

### 4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.2).
- b. Screening (see 4.3).
- c. Conformance inspection (see 4.4).

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500 and as specified herein.

4.2.1 Group E inspection. Group E inspection shall be conducted in accordance with MIL-PRF-19500 and table III herein for qualification or requalification only. In case qualification was awarded to a prior revision of the slash sheet that did not request the performance of table II tests, the tests specified in table II herein must be performed to maintain qualification. Electrical measurements (end-points) shall be in accordance with the applicable steps of table I, subgroup 2 herein and for delta measurements see table III when applicable.

4.2.2 JANHC and JANKC die. Qualification shall be in accordance with appendix H of MIL-PRF-19500.

4.2.3 JANJ devices. For JANJ level, 3.3.1 through 3.3.1.3 of MIL-PRF-19500 shall apply, except as modified herein. Supplier imposed requirements as well as alternate screens, procedures, and/or controls shall be documented in the QM plan and must be submitted to the qualifying activity for approval. When alternate screens, procedures, and/or controls are used, in lieu of the JANJ screens herein equivalency shall be proven and documented in the QM plan. Radiation characterization may be submitted in the QM plan at the option of the manufacturer, however, paragraph 3.3.1.1 of MIL-PRF-19500 is not required. Die lot control and rework shall be in accordance with 3.13 and D 3.13.2.1, for MIL-PRF-19500 JANS level. Lot formation and conformance inspection requirements for JANJ shall be those used for JANTXV devices as a minimum.

4.2.4 JANJ qualification. For JANJ qualification, 4.4.2.1 herein shall be performed as required by the qualifying activity.

4.3 Screening (JANS, JANJ, JANTXV and JANTX levels only). Screening shall be in accordance with table IV of MIL-PRF-19500 (appendix E.), and as specified herein. Specified electrical measurements shall be made in accordance with table I herein. Devices that exceed the limits of table I herein shall not be acceptable.

Screen (see Table IV of MIL-PRF-19500)	JANS Level	JANJ Level	JANTXV and JANTX Level
1a	Required	Not required	Not required
1b	Required	Required	Required (JANTXV only)
2	Not required	Not required	Not required
3a	Required	Required	Required
3b	Not applicable	Not applicable	Not applicable
(1) 3c	Thermal impedance (see 4.3.3)	Thermal impedance (see 4.3.3)	Thermal impedance (see 4.3.3)
4	Not applicable	Not applicable	Not applicable
5	Not applicable	Not applicable	Not applicable
6	Not applicable	Not applicable	Not applicable
7a	Not applicable	Not applicable	Not applicable
7b	Required	Required	Required
8	Required	Not required	Not required
9	$V_{f1}$ and $I_{R1}$	$V_{f1}$ and $I_{R1}$	Not Applicable
10	Method 1038 of MIL-STD-750 condition A	Method 1038 of MIL-STD-750 condition A	Method 1038 of MIL-STD-750 condition A
11	$V_{f1}$ and $I_{R1}$ ; $\Delta V_{f1} \leq \pm 0.1$ V dc $\Delta I_{R1} \leq 250$ nA dc or 100 percent of initial value whichever is greater.	$V_{f1}$ and $I_{R1}$ ; $\Delta V_{f1} \leq \pm 0.1$ V dc $\Delta I_{R1} \leq 250$ nA dc or 100 percent of initial value whichever is greater.	$V_{f1}$ and $I_{R1}$
12	Required, see 4.3.1	Required, T = 240 hours see 4.3.1	Required, see 4.3.1
(2) 13	Subgroups 2 and 3 of table I herein; $\Delta I_{R1} \leq 100$ percent of initial reading or 250 nA dc, whichever is greater. $\Delta V_{f1} \leq \pm 1$ V dc change from initial value. Scope display evaluation (see 4.5.3)	Subgroups 2 and 3 of table I herein; $\Delta I_{R1} \leq 100$ percent of initial reading or 250 nA dc, whichever is greater. $\Delta V_{f1} \leq \pm 1$ V dc change from initial value. Scope display evaluation (see 4.5.3)	Subgroup 2 of table I herein; $\Delta I_{R1} \leq 100$ percent of initial reading or 250 nA dc, whichever is greater. $\Delta V_{f1} \leq \pm 1$ V dc change from initial value. Scope display evaluation (see 4.5.3)
14a	Not applicable	Not applicable	Not applicable
14b	Optional	Optional	Optional
15	Required	Not required	Not required
16	Required	Required	Not required
17	Not required	Required subgroup 2 of table I herein	Not required

- (1) Thermal impedance shall be performed any time after sealing provided temperature cycling is performed in accordance with MIL-PRF-19500, screen 3 prior to this thermal test.
- (2)  $Z_{\theta JX}$  is not required in screen 13, if already previously performed.

4.3.1 Power burn-in test conditions. Power burn-in conditions (all levels) are as follows (see 4.5.1):  $T_A = 50^\circ\text{C}$  max. apply  $V_R =$  full rated  $V_{RWM}$  (see 1.3);  $f = 50\text{-}60\text{ Hz}$ ,  $I_O = I_{O2}$  rated (minimum) (see 4.5.1.1).

4.3.2 Screening (JANHNC and JANKC). Screening of die shall be in accordance with appendix H of MIL-PRF-19500. As a minimum, die shall be 100-percent probed to ensure compliance with group A, subgroup 2. Burn-in duration for the JANKC level follows JANS requirements; the JANHC follows JANTX requirements.

4.3.3 Thermal impedance  $Z_{\theta JX}$  measurements for screening. The  $Z_{\theta JX}$  measurements shall be performed in accordance with method 3101 of MIL-STD-750. The maximum screen limit shall be developed by the supplier using statistical methods and it shall not exceed the group A, subgroup 2 herein.

4.3.3.1 Thermal impedance ( $Z_{\theta JX}$  measurements) for initial qualification or requalification. The  $Z_{\theta JX}$  measurements shall be performed in accordance with method 3101 of MIL-STD-750 (read and record date  $Z_{\theta JX}$ ).  $Z_{\theta JX}$  shall be supplied on one lot (500 pieces minimum and a thermal response curve shall be submitted.) Twenty-two of these samples shall be serialized and provided to the qualifying activity for correlation prior to shipment of parts. Measurements conditions shall be in accordance with 4.4.1.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500 and as specified herein. If alternate screening is being performed in accordance with E.5.3.1d of MIL-PRF-19500, a sample of screened devices shall be submitted to and pass the requirements of group A1 and A2 inspection only (table VIb, group B, subgroup 1 is not required to be performed again if group B has already been satisfied in accordance with 4.4.2).

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with MIL-PRF-19500 and table I herein. The following test conditions shall be used for  $Z_{\theta JX}$ , group A inspection:  $Z_{\theta JX} \leq 1.5^\circ\text{C/W}$ .

- a.  $I_M$  ..... 1 mA to 10 mA.
- b.  $I_H$  ..... 5 A minimum.
- c.  $t_H$  ..... 10 ms.
- d.  $t_{MD}$  ..... 100  $\mu\text{s}$  maximum.
- e.  $t_{SW}$  ..... 5  $\mu\text{s}$  maximum.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the tests and conditions specified for subgroup testing in table VIa (JANS) and table VIb (JAN, JANJ JANTX and JANTXV) of MIL-PRF-19500. Electrical measurements (end-points) requirements shall be in accordance with the applicable inspections of table I, group A, subgroup 2 herein except  $Z_{\theta JX}$  shall be performed after intermittent life only. For delta requirements see table III herein.

4.4.2.1 Group B inspection, table VIa (JANS) of MIL-PRF-19500. For B5 if a failure occurs resubmission shall be at the test conditions of the original sample.

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
B3	4066	$I_{FSM} = 100 \text{ A(pk)}$ , 10 surges of 8.3 ms each at 1-minute intervals, superimposed on $I_O = 2 \text{ A dc}$ ; $V_R = \text{rated } V_{RWM}$ (see 1.3); $T_A = +55^\circ\text{C}$ . This test shall be performed on each subplot.
B4	1037	$I_O = 3 \text{ A dc (min)}$ ; apply $V_R = \text{maximum rated } V_{RWM}$ (see 1.3 and 4.5.1); 2,000 cycles.
B5	1027	$I_O = I_O$ (rated) dc minimum; $T_A = 100^\circ\text{C max.}$ apply $V_R = \text{rated } V_{RWM}$ (see 1.3 and 4.5.2); adjust $T_A$ and $I_O$ to achieve $T_J = +275^\circ\text{C minimum}$ ; $f = 50\text{-}60 \text{ Hz}$ .
	or	$I_O = I_O$ (rated) dc minimum; $T_A = +50^\circ\text{C max.}$ apply $V_R = \text{rated } V_{RWM}$ (see 1.3 and 4.5.2); adjust $T_A$ and $I_O$ to achieve $T_J = +200^\circ\text{C minimum}$ for 1,000 hours at double the sample size.; $f = 50\text{-}60 \text{ Hz}$ .
B6	3101 or 4081	$+25^\circ\text{C} \leq T_A \leq +35^\circ\text{C}$ (recorded before test is performed); $R_{\theta JL}$ (maximum) $\leq 22^\circ\text{C/W}$ ; $L = .375 \text{ inch (9.53 mm)}$ . For surface mount devices (UL and US versions), $R_{\theta JEC} \leq 11^\circ\text{C/W}$ .
B7		Peak reverse power, see 4.5.5 herein. $P_{RM} \geq 1,000 \text{ W}$ . Test shall be performed on each subplot; sampling plan $n = 10$ , $c = 0$ , end points, see table I, subgroup 2 and table III herein.  Delta limits: $\Delta I_R \leq 100 \text{ percent or } 50 \text{ nA}$ , whichever is greater.

4.4.2.2 Group B inspection, table VIb (JAN, JANJ, JANTX and JANTXV of MIL-PRF-19500.

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
B3	1027	$I_O = 3 \text{ A dc minimum}$ ; $T_A = +50^\circ\text{C max.}$ adjust $T_A$ and $I_O$ to achieve the required $T_J$ ; apply $V_R = \text{rated } V_{RWM}$ (see 1.3), $f = 50\text{-}60 \text{ Hz}$ (see 4.5.1.1).

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the tests and conditions specified for subgroup testing in table VII of MIL-PRF-19500. Electrical measurements (end-points) shall be in accordance with table I, group A, subgroup 2 herein; except,  $Z_{\theta JX}$  need not be performed. See table III herein for delta limits when applicable.

4.4.3.1 Group C inspection, table VII of MIL-PRF-19500.

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
C2	2036	Tension: Test condition A; weight = 5 pounds; $t = 30 \text{ seconds}$ . Lead fatigue: Test condition E; weight 2 pounds.  NOTE: Both tension and lead fatigue are not applicable for US devices.
C6	1026	$I_O = I_{O2} 3 \text{ A dc minimum}$ ; $T_A = +50^\circ\text{C max.}$ adjust $T_A$ and $I_O$ to achieve the required $T_J$ ; apply $V_R = \text{rated } V_{RWM}$ (see 1.3), $f = 50\text{-}60 \text{ Hz}$ (see 4.5.1.1).

4.4.4 Group E inspection. Group E inspection shall be performed for qualification or re-qualification only. In case qualification was awarded to a prior revision of the associated specification that did not request the performance of group E inspection. The tests specified herein must be performed to maintain qualification. Group E inspection shall be conducted in accordance with the conditions specified for subgroup testing in appendix E, table IX of MIL-PRF-19500 and as specified herein. Electrical measurements (end-points) shall be in accordance with table I, group A, subgroup 2 herein; except,  $Z_{\theta JX}$  need not be performed. See table III for delta limits when applicable.

4.5 Methods of inspection. Methods of inspection shall be as specified in appropriate tables and as follows.

4.5.1 Burn-in and life tests. These tests shall be conducted with a half-sine waveform of the specified peak voltage impressed across the diode in the reverse direction followed by a half-sine waveform of the specified average rectified current. The forward conduction angle of the rectified current shall be neither greater than 180 degrees, nor less than 150 degrees.

4.5.1.1 Mounting conditions. Any clips or heat sink mounting configurations may be utilized provided that  $I_o$  is adjusted such that the junction temperature of each diode is maintained at  $T_J = 135^\circ\text{C}$  minimum for burn-in and  $T_J = 150^\circ\text{C}$  minimum for life testing.

4.5.2 Pulse measurements. Conditions for pulse measurement shall be as specified in section 4 of MIL-STD-750.

4.5.3 Scope display evaluation. Scope display evaluation shall be sharp and stable in accordance with method 4023 of MIL-STD-750. Scope display may be performed on ATE (automatic test equipment) for screening only with the approval of the qualifying activity. Scope display in group A shall be performed on a scope.

4.5.4 Thermal resistance. Thermal resistance measurements shall be conducted in accordance with test method 3101 or 4081 of MIL-STD-750. Read and record data in accordance with group E herein and shall be included in the qualification report. Forced moving air or draft shall not be permitted across the devices during test. The maximum limit for  $R_{\theta JL}$  under these test condition shall be  $R_{\theta JL} \leq 22^{\circ}\text{C/W}$  for  $L = .375$ ;  $R_{\theta JEC} \leq 11^{\circ}\text{C/W}$  for  $L = 0$  (US version). The following conditions shall apply:

- a.  $I_H$  ..... 2 A minimum.
- b.  $t_H$  ..... Thermal equilibrium.
- c.  $I_M$  ..... 1.0 mA to 10 mA.
- d.  $t_{MD}$  ..... 100  $\mu\text{s}$  maximum.

The device shall be allowed to reach equilibrium at current  $I_H$  before the measurement shall be made ( $t_H \geq 25$  sec).

LS = Lead spacing = .375 inch (9.53) mm minimum for leaded devices and LS = 0 minimum for unleaded devices as defined (see figure 8) (Metric equivalents are given for general information only):

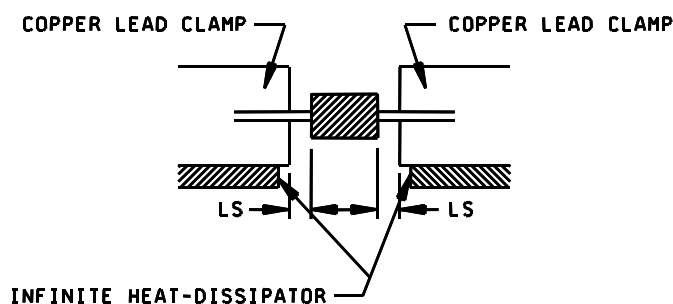


FIGURE 8. Mounting arrangement.

4.5.5 Peak reverse power test. This test shall be measured in the circuit on figure 9 or equivalent. A 20 microsecond half-sine wave of current shall be used and peak reverse power shall be determined by the product of peak reverse voltage and peak reverse current.



TABLE I. Group A inspection.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1</u>						
Visual and mechanical inspection	2071					
<u>Subgroup 2</u>						
Thermal impedance	3101	See 4.3.3	$Z_{\theta JX}$		1.5	°C/W
Forward voltage	4011	$I_f = 9.0$ A(pk); duty cycle $\leq 2$ percent (pulsed); $t_p \leq 8.3$ ms	$V_{f1}$			
1N5550, 1N5550US				0.6	1.2	V(pk)
1N5551, 1N5551US				0.6	1.2	V(pk)
1N5552, 1N5552US				0.6	1.2	V(pk)
1N5553, 1N5553US				0.6	1.3	V(pk)
1N5554, 1N5554US				0.6	1.3	V(pk)
Forward voltage	4011	$I_F = 1.5$ A dc	$V_{F1}$	0.5	1.0	V dc
Reverse current leakage	4016	DC method	$I_{R1}$			
1N5550, 1N5550US		$V_R = 200$ V dc			1.0	$\mu$ A dc
1N5551, 1N5551US		$V_R = 400$ V dc			1.0	$\mu$ A dc
1N5552, 1N5552US		$V_R = 600$ V dc			1.0	$\mu$ A dc
1N5553, 1N5553US		$V_R = 800$ V dc			1.0	$\mu$ A dc
1N5554, 1N5554US		$V_R = 1,000$ V dc			1.0	$\mu$ A dc
Breakdown voltage (diodes)	4021		$V_{BR1}$			
1N5550, 1N5550US		$I_R = 50$ $\mu$ A dc		240		V dc
1N5551, 1N5551US		$I_R = 50$ $\mu$ A dc		460		V dc
1N5552, 1N5552US		$I_R = 50$ $\mu$ A dc		660		V dc
1N5553, 1N5553US		$I_R = 50$ $\mu$ A dc		880		V dc
1N5554, 1N5554US		$I_R = 50$ $\mu$ A dc		1,100		V dc
<u>Subgroup 3</u>						
High temperature operation:		$T_A = +100^\circ\text{C}$				

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 3</u> - Continued						
Reverse current leakage	4016	DC method	$I_{R2}$			
Reverse current leakage		DC method				
1N5550, 1N5550US		$V_R = 200 \text{ V dc}$			75	$\mu\text{A dc}$
1N5551, 1N5551US		$V_R = 400 \text{ V dc}$			75	$\mu\text{A dc}$
1N5552, 1N5552US		$V_R = 600 \text{ V dc}$			75	$\mu\text{A dc}$
1N5553, 1N5553US		$V_R = 800 \text{ V dc}$			75	$\mu\text{A dc}$
1N5554, 1N5554US		$V_R = 1,000 \text{ V dc}$			75	$\mu\text{A dc}$
Forward voltage	4011	$I_f = 9.0 \text{ A(pk)}$ ; duty cycle $\leq 2$ percent (pulsed); $t_p \leq 8.3 \text{ ms}$	$V_{f2}$			
1N5550, 1N5550US					1.2	V(pk)
1N5551, 1N5551US					1.2	V(pk)
1N5552, 1N5552US					1.2	V(pk)
1N5553, 1N5553US					1.3	V(pk)
1N5554, 1N5554US					1.3	V(pk)
Low temperature operation:		$T_A = -55^\circ\text{C}$				
Forward voltage	4011	$I_f = 9.0 \text{ A(pk)}$ ; duty cycle $\leq 2$ percent (pulsed); $t_p \leq 8.3 \text{ ms}$	$V_{f3}$		1.5	V(pk)
Forward voltage	4011	$I_F = 1.5 \text{ A dc}$	$V_F$	0.5	1.2	V dc
Breakdown voltage (diodes)	4021		$V_{BR2}$			
1N5550, 1N5550US		$I_R = 50 \mu\text{A dc}$		200		V dc
1N5551, 1N5551US		$I_R = 50 \mu\text{A dc}$		400		V dc
1N5552, 1N5552US		$I_R = 50 \mu\text{A dc}$		600		V dc
1N5553, 1N5553US		$I_R = 50 \mu\text{A dc}$		800		V dc
1N5554, 1N5554US		$I_R = 50 \mu\text{A dc}$		1,000		V dc
<u>Subgroup 4</u>						
Reverse recovery time	4031	Condition B-1	$t_{rr}$		2.0	$\mu\text{s}$
Scope display	4023	See 4.5.3 $n = 116, c = 0$				

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroups 5</u> Not applicable <u>Subgroup 6</u> Surge current  <u>Subgroup 7</u> Not applicable	4066	$I_{FSM} = 100 \text{ A(pk)}$ , 10 surges of 8.3 ms each at 1-minute intervals, superimposed on $I_O = 2 \text{ A dc}$ ; $V_R = \text{rated } V_{RWM}$ (see 1.3); $T_A = +55^\circ\text{C}$ . This test shall be performed on each subplot.				

1/ For sampling plan, see MIL-PRF-19500.

TABLE II. Group E inspection (all quality levels) for qualification only.

Inspection	MIL-STD-750		Sampling plan
	Method	Conditions	
<u>Subgroup 1</u>			22 devices c = 0
Temperature cycling	1051	500 cycles, condition C	
Electrical measurements <u>1/</u>		See table I, group A, subgroup 2	
<u>Subgroup 2</u>			22 devices c = 0
Steady-state dc blocking life	1038	1,000 hours, condition A $V_R = V_{RWM}$	
Electrical measurements <u>1/</u>		See table I, group A, subgroup 2	
<u>Subgroup 3</u>			
Not applicable			
<u>Subgroup 4</u>			22 devices c = 0
Thermal resistance	3101 or 4081	See 4.5.4; $R_{\theta JL} = 22^\circ\text{C/W}$ $R_{\theta JEC} = 11^\circ\text{C/W}$	
Junction temperature rise (see 4.5.4)		See figures 10, 11 and 12; $\Delta T_J \leq 120^\circ\text{C}$ ; $L = .375$ inch; $T_L = 55^\circ\text{C}$ ; $I_O = 5$ A dc <u>2/</u>	
<u>Subgroup 5</u>			22 devices c = 0
Barometric pressure, reduced (altitude operation)	1001	Pressure (see 1.3); $t = 1$ min. DC method; $V_R = V_{RWM}$ (see 1.3) $I_{R1} = 1.0$ $\mu\text{A}$ dc maximum	
<u>Subgroup 6</u>			
Not applicable			
<u>Subgroup 7</u>			n = 22, c = 0
Peak reverse power		See 4.5.5 herein. $P_{RM} \geq 1,000$ W. Test shall be performed on each subplot; sampling plan: , , end-points see table I, subgroup 2 and table III delta limits herein.	

1/  $Z_{\theta JX}$  not applicable.2/ For surface mount device,  $I_O = 5$  A dc and  $T_{EC}$  (end cap temperature) =  $75^\circ\text{C}$ .

TABLE III. Delta requirements. 1/ 2/ 3/ 4/

Step	Inspection	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1.	Reverse current leaking change	4016	DC method	$\Delta I_{R1}$ 4/		±100 percent of initial value or ±250 nA dc, whichever is greater.	
2.	Forward voltage change	4011	$I_F = 1.5$ A dc; pulsed (see 4.5.2)	$\Delta V_{F1}$ 4/		±50 mV dc maximum change from previous measured value.	

1/ The electrical measurements for table VIa (JANS) of MIL-PRF-19500 are as follows:

- a. Subgroup 3, see table III herein, step 2.
- b. Subgroup 4, see table III herein, step 2.
- c. Subgroup 5, see table III herein, steps 1 and 2.

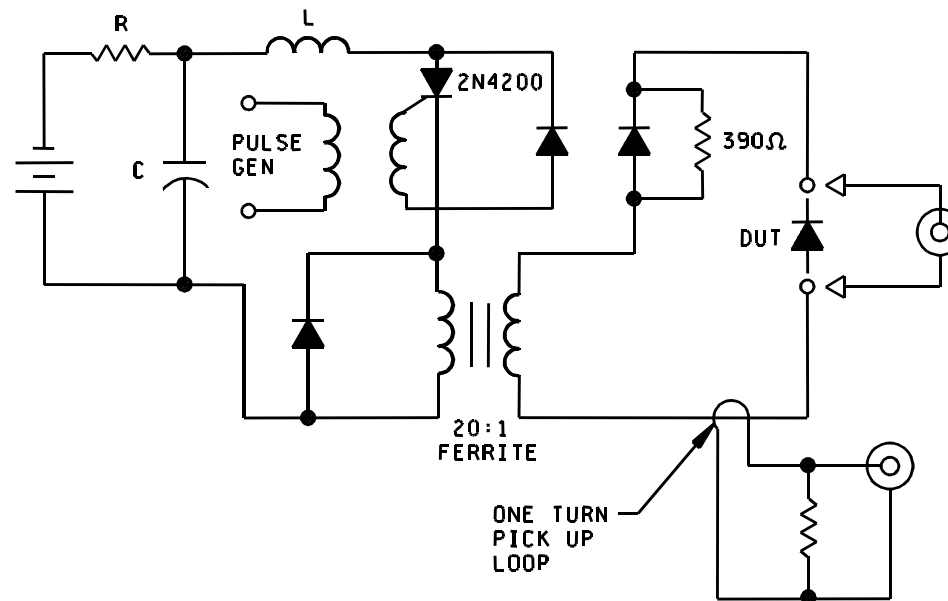
2/ The electrical measurements for table VIb (JAN, JANJ, JANTX and JANTXV) of MIL-PRF-19500 are as follows:

- a. Subgroup 3, see table III herein, step 1.
- b. Subgroup 6, see table III herein, step 1.

3/ The electrical measurements for table VII of MIL-PRF-19500 are as follows:

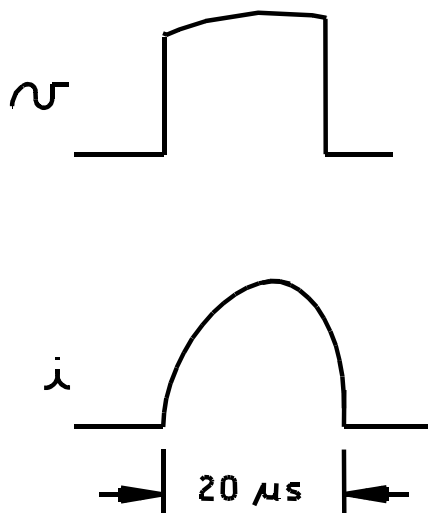
- a. Subgroup 2, see table III herein, step 1 (JANS).
- b. Subgroup 6, see table III herein, step 1 and 2 (JANS), step 1 (JAN, JANTX, JANTXV and JANJ).

4/ Devices which exceed the group A limits for this test shall not be accepted.



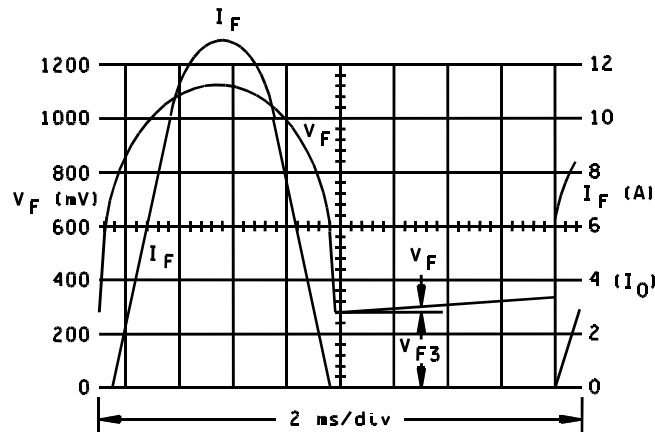
## NOTES:

1. L = 13T H22 on 1 inch diameter form (air core).
2. C = 1 to 10  $\mu\text{F}$  to give 20  $\mu\text{s}$  pulse width.
3. V = Adjustable to 200 volts for power desired in device under test.



## TYPICAL WAVEFORMS

FIGURE 9. Typical peak reverse power measurement circuit and waveforms.



NOTE: Blocking diode shall have a forward current rating  $\geq 6$  A dc.

FIGURE 10. Junction temperature rise test circuit.

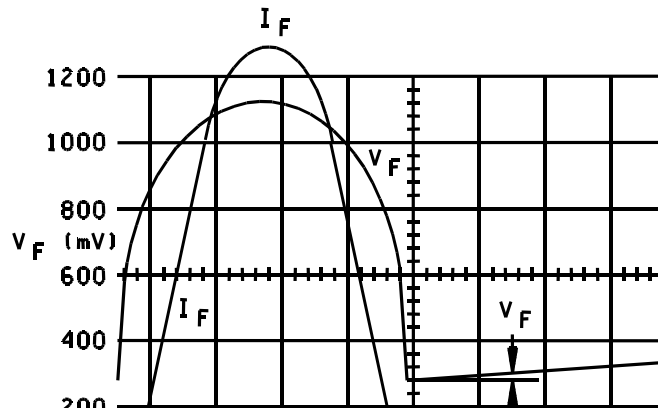


FIGURE 11. Junction temperature test oscillogram (typical).

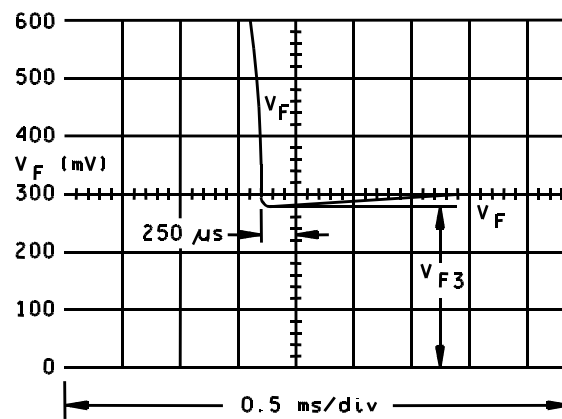


FIGURE 12. Expanded oscillogram of  $V_F$ .



## 5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

## 6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The notes specified in MIL-PRF-19500 are applicable to this specification.

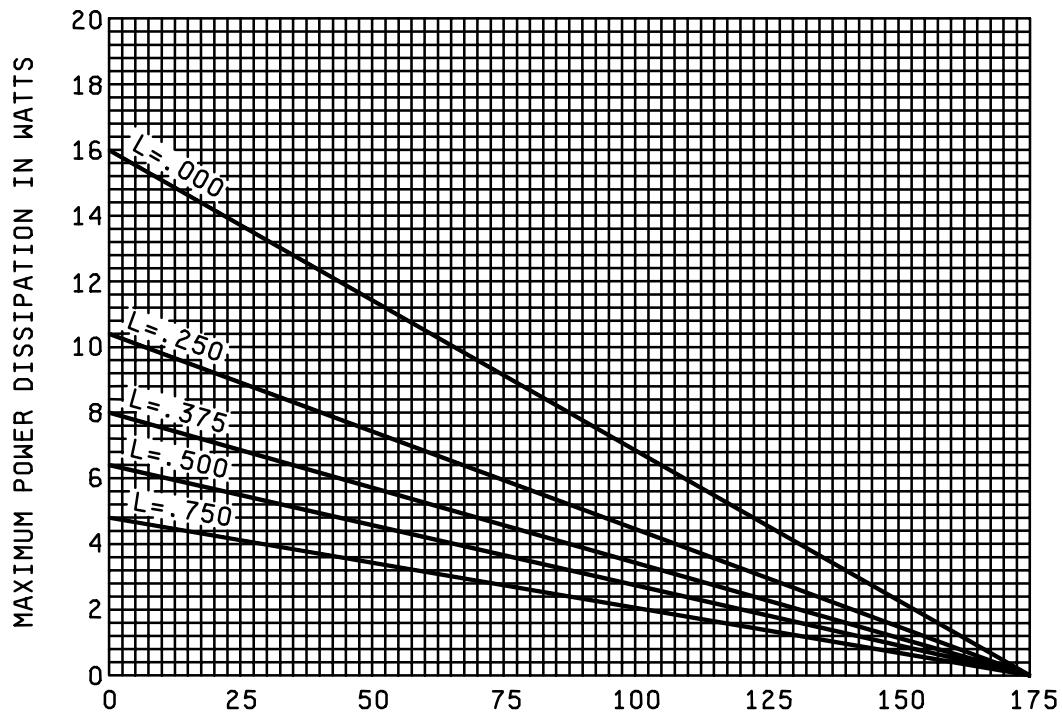
6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification.
- b. Issue of DODISS to be cited in the solicitation and if required, the specific issue of individual documents referenced (see 2.2.1).
- c. The lead finish as specified (see 3.4.1).
- d. Type designation and quality assurance level.
- e. Packaging requirements (see 5.1).
- f. For die acquisition, the JANHC or JANKC letter version shall be specified (see figures 3 and 4).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Manufacturer's List (QML) No.19500 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from, Defense Supply Center Columbus, ATTN: DSCC-VQE, P.O. Box 3990, Columbus, OH 43216-5000.

6.4 Supersession information. Devices covered by this specification supersede the manufacturers' and users' Part or Identifying Number (PIN). This information in no way implies that the manufacturers' PIN's are suitable as a substitute for the military PIN.

6.5 Applications data. See figure 13 for maximum power in watts as a function of lead temperature at a distance "L" from the diode body. Device current capability with lead-dissipators or body forced-air-cooling, may be determined from figure 14, which shows maximum average rectified current versus lead temperature as a function of the distance L from the diode body at which lead temperature is measured.



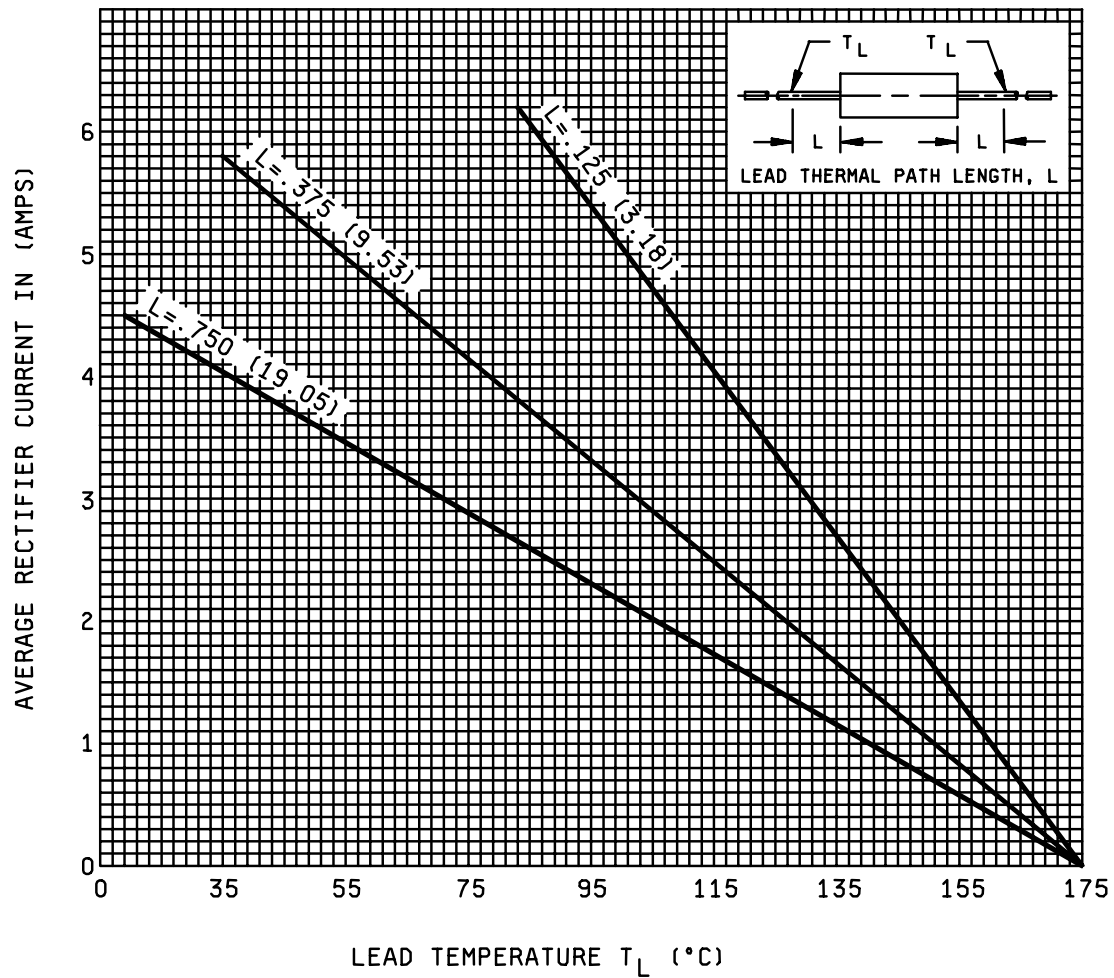
Maximum lead temperature in °C ( $T_L$ ) at point "L" from body (for maximum operating junction temperature of +175°C with equal two-lead conditions).

L		$R_{\theta JL}$
Inches	mm	°C/W
.000	0.00	11
.250	6.35	16.5
.375	9.53	22
.500	12.70	26
.750	19.05	35.5

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.

FIGURE 13. Maximum power in watts versus lead temperature.



## NOTES

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.

FIGURE 14. Maximum current vs lead temperature.

6.6 Suppliers of die. The qualified die suppliers with the applicable letter version (example JANHCA1N5550) will be identified on the QML.

JANC ordering information					
PIN	Manufacturer				
	14552	60211	13409	33178	33178
1N5550	JANHCA1N5550 JANKCA1N5550	JANHCB1N5550	JANHCC1N5550	JANHCD1N5550	JANHCE1N5550
1N5551	JANHCA1N5551 JANKCA1N5551	JANHCB1N5551	JANHCC1N5551	JANHCD1N5551	JANHCE1N5551
1N5552	JANHCA1N5552 JANKCA1N5552	JANHCB1N5552	JANHCC1N5552	JANHCD1N5552	JANHCE1N5552
1N5553	JANHCA1N5553 JANKCA1N5553	JANHCB1N5553	JANHCC1N5553	JANHCD1N5553	JANHCE1N5553
1N5554	JANHCA1N5554 JANKCA1N5554	JANHCB1N5554	JANHCC1N5554	JANHCD1N5554	JANHCE1N5554

6.7 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians:  
 Army - CR  
 Navy - NW  
 Air Force - 11  
 DLA - CC

Preparing activity:  
 DLA - CC

Review activities:  
 Army - AR, MI, SM  
 Navy - AS, MC  
 Air Force - 19, 84, 99

(Project 5961-2437)

## STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

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2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

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<b>I RECOMMEND A CHANGE:</b>	1. DOCUMENT NUMBER MIL-PRF-19500/420F	2. DOCUMENT DATE 011009
<b>3. DOCUMENT TITLE</b> SEMICONDUCTOR DEVICE, DIODE, SILICON, POWER, RECTIFIER, GENERAL PURPOSE TYPES 1N5550 THROUGH 1N5554, 1N5550US THROUGH 1N5554US JAN, JANTX, JANTXV, JANJ, JANS, JANHC, AND JANKC		
<b>4. NATURE OF CHANGE</b> (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)		
<b>5. REASON FOR RECOMMENDATION</b>		
<b>6. SUBMITTER</b>		
a. NAME (Last, First, Middle initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) COMMERCIAL DSN FAX EMAIL	7. DATE SUBMITTED
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c. ADDRESS Defense Supply Center, Columbus ATTN: DSCC-VAC, P.O. Box 3990 Columbus, OH 43216-5000	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Standardization Program Office (DLSC-LM) 8725 John J. Kingman, Suite 2533, Fort Belvoir, VA 22060-6221 Telephone (703) 767-6888    DSN 427-6888	

**DD Form 1426, Feb 1999 (EG)**

Previous editions are obsolete

WHS/DIOR, Feb 99